

CAMERA

This application is based on patent application 2000-097389 filed in Japan, the contents of which are hereby incorporated by references.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a camera which can communicate with another electronic equipment such as a personal computer.

2. Description of the Related Art

In a camera such as a digital camera, an optical image of an object is focused on a surface of an image pickup device, and light energy corresponding to the optical image is transferred to electric energy by photoelectric transfer in each pixel of the image pickup device. An image data corresponding to the image focused on the image pickup device is constituted by electric signals from the pixels. The image data is processed with a predetermined signal processing such as white balance adjustment by a CPU (Central Processing Unit) with a processing program therefor. After the signal processing, the image data is recorded in an recording medium such as a detachable memory card.

In recent years, a number of pixels of the image pickup device is largely increased, so that it is necessary to compress the image data for increasing a number of image data to be recorded in the memory card. The compression of the image data is executed by the CPU

with the program therefor or by a dedicated integrated circuit called ASIC (Application Specific Integrated Circuit) in the digital camera. Furthermore, when the image recorded in the memory card is reproduced, the compressed image data will be extended by the CPU or the ASIC.

When the compression and extension of the image data are executed by the CPU with the program, it occupies much time for data processing of the image data. Alternatively, when the compression and extension of the image data are executed by the ASIC, the processing time of the image data becomes shorter than that in the above-mentioned case, but a lot of circuit elements are necessary for configuring the ASIC corresponding to the increase of the number of pixels of the image pickup device, so that the ASIC or the digital camera containing the ASIC will be upsized. Thus, it is desired to provide a method or a mechanism for processing the compression and extension of the image data in a short time by the ASIC without upsizing the digital camera.

On the other hand, the digital camera generally has an interface for communicating with another electronic equipment such as a personal computer. In recent years, kinds of the interfaces for communicating between the digital camera and the personal computer are multiplied, so that it is preferable to provide several kinds of the interfaces in the digital camera as much as possible.

However, when a plurality of interfaces are realized by programs, it occupies much time for communicating the image data

alternative of a logic circuit fitting to the first image data processing when the first image data processing is selected and another logic circuit fitting to the second image data processing when the second image data processing is selected. The calculator can be configured by, for example, a programmable gate array such as FPGA (Field Programmable Gate Array), so that processing speed of the image data processing can be fastened than that executed by a CPU with a predetermined image processing program. Furthermore, the same calculator can be used two logic circuits, so that the circuit configuration can be made simple.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front view for showing an appearance of a digital camera which is an embodiment of an electronic camera in accordance with the present invention;

FIG. 2 is a rear view of the digital camera;

FIG. 3 is a bottom view of the digital camera;

FIG. 4 is a right side view of the digital camera;

FIG. 5A is a front view for showing an example of an image displayed on a monitor display of the digital camera using an image data taken by an image pickup device in image pickup mode in the embodiment;

FIG. 5B is a front view for showing an example of an image reproduced on the monitor display using an image data recorded in a memory card in reproducing mode in the embodiment;

FIG. 5C is a front view for showing an example of a menu

n image displayed on a monitor display of the digital camera in menu mode in the embodiment;

FIG. 6 is a schematic view for showing a data communication between the digital camera and another electronic equipment such as a personal computer;

FIG. 7 is a front view for showing an arrangement of terminals of a connector of the digital camera in the embodiment;

FIG. 8 is a block diagram showing a configuration of the digital camera in the embodiment;

FIG. 9 is a schematic view for showing a configuration of an image data recorded in the memory card in the embodiment;

FIG. 10 is a flowchart showing an operation of the digital camera in the embodiment;

FIG. 11 is a flowchart showing an operation of the digital camera in PC mode in the embodiment;

FIG. 12 is a block diagram showing a modified configuration of the digital camera in the embodiment;

FIG. 13 is a graph for showing characteristic curves for γ compensation of the image data in the modification of the embodiment;

FIGS. 14A to 14E are tables for showing arrangements of filtering coefficients used for contour emphasizing compensation of the image when compression ratio $K=1/8$ in the modification of the embodiment;

FIGS. 15A to 15E are tables for showing arrangements of

filtering coefficients used for contour emphasizing compensation of the image when compression ratio $K=1/20$ in the modification of the embodiment; and

FIG. 16 is a table for showing an arrangement of the filtering coefficients in the modification of the embodiment.

DETAILED DESCRIPTION OF THE EMBODIMENT

An embodiment the present invention is described. In the description of the embodiment, "right" and "left" are standardized by a user observing a viewfinder of the digital camera.

FIG. 1 is a front view of a digital camera which is the embodiment of the electronic camera in accordance with the present invention. FIG. 2 is a rear view of the digital camera. FIG. 3 is a right side view of the digital camera. FIG. 4 is a bottom view of the digital camera.

As can be seen from the figures, the digital camera 1 is configured by a box-shaped camera body 2 and an image pickup unit 3 detachably coupled with the left side of the camera body 2.

As shown in FIG. 1, a flash device 5 is disposed at upper center portion on a front face 2a of the camera body 2. A holding grip 4 is provided at right side on the front face 2a of the camera body 2. A shutter start switch 9 is provided in the vicinity of the right end on an upper face 2b of the camera body 2.

A taking lens 301 such as a zoom lens is provided substantially at the center of a front face 3a of the image pickup unit 3. An image pickup device 303 (see FIG. 8) such as CCD (Charge Coupled device)

